CENTRAL INTELLIGENCE AGENCY

CONFIDENTIAL

INFORMATION REPORT

REPORT

CD NO.

COUNTRY USSR

DATE DISTR 18 JUL 50

SUBJECT Borets Engineering Works No. 414 in Moscow

NO. OF PAGES 10

PLACE ACQUIRE

NO. OF ENCLS. (LISTED BELOW)

50X1-HUM

DATE OF INFO.

SUPPLEMENT TO REPORT NO.

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Identification

1. The Order of Lenin and Order of the Labor Red Banner Engineering Works Borets No. 414 (Ordena Lenina I Ordena Trudovogo Krasnogo Znameni Mashinostroitelny Zavod Borets No. 414) is located at 6 Skladochnaya Ulitsa in the Dzerzhinski area of Moscow. There is a special branch line connecting the works with the Kalinin Railway. Before the war, the Borets works were numbered 92, but when the works and factories of the Oil Industry were renumbered, they received the number 414. In the early days of the works they were known as Butyrski Zavod.

2. The Works are controlled by the Oil Engineering Central Administration (Glavnoye Upravleniye Neftyanogo Mashinostroyeniya, or Glavneftemash) of the Ministry for Oil Industry of the USSR (Ministerstvo Neftyanoi Promyshlennosti USSR). Before the two ministries for oil industry which previously existed were amalgamated, the works belonged to the Ministry for Oil Industry of the Eastern Areas and was under the direct control of the Central Administration of Oil Engineering of the Eastern Areas.

History

3. The works were founded in 1897 and at first produced fire engines and centrifugal steam pumps. Later the production of compressors was started. After the Revolution the works specialized in the production of pumps and compressors. At that time they belonged to the People's Commissariat for Heavy Industry, but about 1930 they came under the control of the People's Commissariat for Oil Industry.

4. The works produced the first compressor in 1910 and the first vertical compressor in 1934. Before the war, the output of the works went chiefly to the oil industry, coal industry and Navy. Many naval and other vessels were equipped with compressors from the works. These included the battleship SEVASTOPOL, numerous submarines, and the icebreaker JOSEF STALIN.

5. The works, which fulfilled large orders in connection with the construction of the Volga-Moscow Canal, produced compressor and pump equipment for the locks. The equipment included 20 propeller pumps, unequalled both in output and size, which pumped 25 cubic meters of water per second.

6. The works have produced and are still producing for the Moscow Underground Railway (Metro) a great quantity of large compressors with spare parts.

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Class. Changed To: TS S C
Auth.: HR 70-2
Date: 12 JAN 1971 By:

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7. The works executed large orders in connection with the construction of the largest industrial undertakings in the Soviet Union which included the following:

   a. Magnitogorsk Construction Company (Magnitogorskstroi)

   b. Kuznetsk Construction Company (Kuznetskstroi)

   c. Stalingrad Tractor Works.

   d. Kharkov Tractor Works

   e. Moscow Thermo-electric Power Station in the Dzerzhinski Area.

8. During and after the war, the works produced a large number of parts such as pistons, rods, and cast iron compressor rings for the powerful compressors of the Saratov-Moscow gas pipeline.

9. In the industrial mobilization plan the works were earmarked for the production of ammunition including shells and bombs. As early as 1937, a shop was equipped for the manufacture of artillery projectiles. During the Soviet-Finnish War, the works delivered large quantities of ammunition for the front.

10. At the outbreak of the Soviet-German war, some specialists and a proportion of special equipment for the production of oil machinery were evacuated to the south. The remainder, which comprised the larger part of the works, was switched over to the production of ammunition and bombs. During the first year of the war, the works produced about 300,000 bombs and a large number of projectiles of two types. As the war continued, owing to the introduction of the conveyer system and to the gradual training of workers to perform similar work, the output increased three to fourfold.

11. Beginning in the autumn of 1942 when the position in Moscow became stabilized, one of the workshops reverted to the production of spare parts for pumps and compressors for the oil industry and the Navy. In 1944, the works gradually switched over to their peacetime production and started turning out large numbers of spare parts for compressors and pumps, and later compressors, pumps, and other machinery. At the end of 1945, the works attained their pre-war output.

12. During the war, the works, in competition with other factories, were awarded the Challenge Red Banner of Trade Unions and of the People's Commissariat on 44 occasions. The works continued to be successful in competitions after the war, and, since December 1947, have retained the Red Banner of the Ministry for Oil Industry.

13. In 1945 at the end of hostilities, some of the workers of the factory were discharged and the remainder are being gradually put through special technical courses embracing new working methods.

14. During the first post-war Five Years Plan, the works, in addition to producing compressors and pumps, started producing new machinery such as steam engines, Diesel oil engines, steam turbines, and turbine drills.

15. At the present time, a new industrial building 100 m by 40 m is being completed at the works.

Type of Produce

16. Since the war, the Borets Works have been producing mainly compressors and pumps which have been distributed as follows:

   a. About 75 percent to the oil industry.

   b. About 10 percent to the Navy and Mercantile Marine.

   c. About 10 percent to the coal industry (in December 1949, the works received an order for 50 compressors for the coal mines. The compressors are of a special type similar to SG-8 and 2SG-50).

   d. About 5 percent consists of orders for the Moscow Underground Railway, the Saratov-Moscow gas pipeline, the Moscow-Volga Canal, and similar projects.

17. In addition to compressors and pumps, the following are produced in series:

a. Several types of Diesel oil engines

b. Steam engines

c. Steam turbines

d. Turbine drills (Mainly spare parts for turbine drills)

e. Small turbines for cleaning pumps and compressor pipes

f. Ventilators for cooling towers (gradirnya)

18. The works also execute individual orders for machinery such as winches and lifting gear for assembling oil derricks.

19. All production from the works for the oil industry is intended for the so called "Second Baku" oil wells and geological prospecting organizations.

Details of Machinery Produced

Compressors

20. Compressors for the oil industry which have been in small and medium series production since the war include the following:

a. Type KI is a horizontal two-stage compressor.

Diam. of cylinders: 380 mm, 170 mm
Piston Stroke: 400 mm
Maximum number of revolutions per minute: 150
Pressure: 35 atmospheres
Output: about 13 cubic meters per minute
Electric motor requiring 100 KW
Weight of compressor: 7,760 kg

This compressor, as well as other horizontal compressors, was being built before the war. These compressors were modelled on the USA Ingersoll Rand compressors type II.

b. Type 2 SG-8 (Spetsialno-Gazovy Kompressor, Special Gas Compressor) is the modernized SG-8. Series production of 2 SG-8 started at the beginning of 1947.

Vertical two-stage compressor.
Diam. of cylinders: 510 mm, 300 mm
Piston Stroke: 250 mm
Maximum number of revolutions per minute: 365
Pressure: 8 atmospheres
Operational output: about 25 cubic meters per minute
(theoretical output: about 35 cubic meters per minute)
Weight of compressor: 6,000 kg
Electric motor of 190 KW (about 250 HP)

There are several other types of compressors with 8 atmospheres compression pressure, such as VG-8 (Vozdushno-Gazovy Kompressor, Air and Gas Compressor), still working at the oil wells. These were built by the works before the war but are no longer being built. Compressors of the type 8 (VG-8, SG-8, 2 SG-8) are employed in the oil industry in conjunction with coupled high pressure cylinders of the KI compressor, acting as a low pressure stage.

c. Type SG-25 is a vertical, two-stage compressor.

Diameter of cylinders: 370 mm, 170 mm
Piston Stroke: 250 mm
Maximum number of revolutions per minute: 365
Pressure in atmospheres: 25
Output: about 20 cubic meters per minute (Operational output is about 11 cubic meters per minute)
Fitted with electric motor requiring 190 KW (250 HP)

d. Types SG-50 and 2 SG-50 are vertical, three-stage compressors.

Diameter of cylinders: 370 mm, 225 mm, 190 mm
Piston Stroke: 250 mm

Maximum number of revolutions per minute: 365
Pressure in atmospheres: 50
Theoretical output: about 20 cubic meters per minute
Operational output: about 12 cubic meters per minute
Electric motor requiring 190 KW
Weight of compressor: 7500 kg

The VG-50 type compressors formerly produced at the Borets Works are similar to the Sg-50. The weight of VG-50 is 7000 kg.

e. Types DSG-100 and 2 DSG-100 are re-compressing (Dozhimnoi) compressors. Series production of these compressors was started in December 1947.

Intake (Priyom) Pressure: 50 atmospheres
Output: up to 56 cubic meters per minute
Pressure: 100 atmospheres
Maximum number of revolutions per minute: 365
Electric motors of 100 to 250 KW from the factories Dynamo, and Elektrosila are mostly used for driving these compressors.

f. Type MK-2 is a two-stage, two cylinder compressor with gas engine drive.

Diameter of cylinders: 430 mm, 178 mm
Piston Stroke: 355 mm
Maximum revolutions per minute: 300
Pressure in atmospheres: 35
Output: 31 cubic meters per minute
Engine power: 200 HP

g. Type MK-3 is a three-stage, three cylinder compressor with gas engine drive. Compressors MK-2 and MK-3 are modelled, with a few modifications, on the RA gas enbine compressors built by the American firm of Clark.

Diameter of cylinders: 430 mm, 240 mm, 125 mm
Piston Stroke: 355 mm
Maximum revolutions per minute: 300
Pressure in atmospheres: 50
Output: 31 cubic meters per minute
Engine power: 300 HP
Weight of compressor: 18,500 kg

h. Type RA-3 is an exact copy of the RA-3 compressor which is produced by the American firm of Clark. It is a three stage compressor with a two-stroke gas engine. Engine power is 300 HP. A small number of these compressors has been built. Production of spare parts, such as cylinders which are almost identical with the MK type cylinders, continues.

i. Type 2 SA-8 is vertical.

Revolutions per minute: 480
Required power: 75 KW
Compression pressure: 8 atmospheres
Weight: 3700 kg

j. Air compressors types EK-180 and K-180 are high speed vertical compressors. These compressors are employed for small stationary oxygen plants. More powerful compressors for oxygen plants are produced at works at Sumy, Chirchik, and Kharkov. The EK type compressor is directly connected with an electric motor. The designation E denotes Elektrodvigatel (electric motor) and K denotes Kislorodny (oxygen). Type K compressor has a belt drive.

Output: 180 cubic meters per hour
End pressure: 220 atmospheres
Number of revolutions per minute: 365
Power of electric motor: 60 KW
Diameters of cylinders: 1st stage - 270 mm, 2nd stage - 165 mm, 3rd stage - 75 mm, and 4th stage - 40 mm
Piston stroke: 200 mm

k. Compressor type K-18 and two new compressors which are awaiting trials.

l. Mobile air compressor Vostok. The compressor is mounted with a petrol engine on a trailer.

m. Mobile (self-propelling) compressors driven by motor vehicle engine. Small output compressor developing pressure up to 75 atmospheres.

n. The works also produce spare parts for compressors which were built previously but are no longer produced. These are the following:

1) Type VG-8 - very similar to SG-8.

2) Type VV-8 - vertical, with Texrope (multiple V-belt) drive.
Compression pressure: 8 atmospheres
Revolutions per minute: 430
Required power: 135 KW
Weight: 4800 kg

3) Type VB-2, vertical, with Texrope drive.
Compression pressure: 2 atmospheres
Revolutions per minute: 430
Required power: 135 KW
Weight: 4000 kg

4) Type VG-2, vertical, with Texrope drive.
Pressure: 2 atmospheres
Revolutions per minute: 365
Required power: 190 KW
Weight: 5100 kg

5) Type KN-6.
Output: about 20 cubic meters per minute
Weight: 7000 kg

6) Type VB-8.
Output: 15 cubic meters per minute
Weight: 5300 kg

7) Turbocompressor type TK-250-8.
Number of stages: 12
Diameters of wheel: 750, 550 mm
Overall dimensions: length - 11,000 mm; width - 3500 mm; height - 1600 mm
Weight: 23,300 kg
Compression pressure: 8 atmospheres
Revolutions per minute: 6000
Required engine power: 1900 KW
Volume of compressed air: 250 cubic meters per minute

Pumps

21. Pumps of various types have been turned out for the oil industry in small and medium series production since the war. These include the following:

a. Type VO-75, power-driven piston pump for water and oil products.

Output: 5 cubic meters per hour
Pressure: 3-6 atmospheres
Two cylinders; diameter of cylinder: 75 mm
Piston stroke: 90 mm
Number of double strokes: 71 per minute
Gear drive
Required power: 1 HP
Overall dimensions: length - 650 mm; width - 625 mm; height - 1380 mm
Weight: 98 kg

b. Type VO-100, power-driven piston pump for water and oil products.

Output: 20 cubic meters per hour
Pressure in atmospheres: 3-6
Two cylinders; diameter of cylinder: 100 mm
Stroke of piston: 150 mm
82 double strokes per minute
Gear drive
Required power: 3.3 HP
Overall dimensions: length - 790 mm; width - 684 mm; height - 1810 mm
Weight: 160 kg

c. Type VO-140 is a power-driven piston pump for water and oil products.

Output: 30 cubic meters per hour
Pressure in atmospheres: 4
Two cylinders; diameter of cylinder: 140 mm
Piston stroke: 100 mm
Number of double strokes: 55 per minute
Overall dimensions: length - 970 mm; width - 816 mm; height - 2210 mm
Weight: 320 kg

d. Type VO-170 is a power-drive piston pump for water and oil products.

Output: 50 cubic meters per hour
Pressure: 2.4 atmospheres
Two cylinders; diameter of cylinder: 170 mm
Piston stroke: 200 mm
Number of double strokes: 54 per minute
Required power: 9 HP
Overall dimensions: length - 1818 mm; width - 1087 mm; height - 1696 mm
Weight: 320 kg

e. Type VO-200 is a power-driven piston pump for water and oil products.

Output: 75 cubic meters per hour
Pressure: 7 atmospheres
Two cylinders; diameter of cylinder: 200 mm
Piston stroke: 250 mm
Number of double strokes: 48 per minute
Gear drive
Required engine power: 33 HP
Overall dimensions: length 2326 mm; width - 1210 mm; height - 1995 mm
Weight: 900 kg

f. Type NB-600/15 is a power-driven piston pump for water and oil products.

Output: 50 cubic meters per hour
Pressure: 15 atmospheres
Two cylinders; diameter of cylinder: 130 mm
Piston stroke: 260 mm
Number of double strokes: 65
Texrope drive
Required power: 40 HP
Overall dimensions: length - 2200 mm; width - 1050 mm;
height - 700 mm
Weight: 1580 kg

g. Five types of centrifugal pumps for oil are being produced which include the following: (The number of stages in types 1, 2, and 3 is from 4 to 6.)

1) Centrifugal pump with an output of 86 cubic meters per hour.

2) Centrifugal pump with an output of 160 cubic meters per hour. It has four wheels, each with a diameter of 150 mm.
Revolutions per minute: 1450
Output: 160 cubic meters per hour
Pressure: 150 meters water column
Required power: 150 HP

3) Centrifugal pump with an output of 280 cubic meters per hour. This centrigugal pump has five wheels, each of 150 mm.
Revolutions per minute: 1450
Pressure: 120 meters water column
Required power: 200 HP

4) A powerful pump for main oil pipelines MT-45 (Magistralnaya Transportirovka, Mainline Transport). This pump which is used for pumping oil long distances has a very large output. Series production of these pumps started in September 1949.

h. Steam piston pumps for pumping hot oil products. It is possible to pump oil products with a temperature up to 500° C.

Output: 90 cubic meters per hour, at a pressure of
65 atmospheres.
52 double strokes

i. The works produce five types of mud pumps:

1) High speed mud pump type NGB with up to 95 strokes and output about 45 liters per second.

2) Mud pump with 70 strokes per minute, output of 44 liters per second, and pressure up to 140 atmospheres.

3) Mud pump NG-4 with an output of 18 liters per second and a pressure of 30 atmospheres.

4) Power-driven mud pump NG-7 with an output of 20 liters per second and a pressure of 30 atmospheres.

5) Mud pump NG-30/320 with an output of 30 liters per second, pressure of 60 atmospheres, and hydraulic power of 320 HP.

At present, mud casings for mud pumps are made of the so-called "modified" pigiron. Previously, they were made of steel forgings. The "modified" pigiron mud casings received special thermic treatment and their durability greatly exceeds that of steel jackets.

j. The works produce two types of cementing pumps, one of which is designated TsNB-80. These pumps serve for cementing walls of oil wells with a clay solution which is forced on at high pressure during the drilling of oil wells. They have two double action cylinders with a pressure up to 80 atmospheres, power of 135 HP, and 75 revolutions per minute.

k. The works produce a propane pump type PN. The pump is steam driven and has an output of up to 30 cubic meters per hour. The pump is used for pumping liquid propane which is liquified at a pressure of 6 atmospheres.

Pressure: 40 atmospheres
Dimensions of steam cylinders: 370 mm
Dimensions of pump cylinders: 160 mm
Piston stroke: 450 mm
Weight of pump: 1400 kg

l. During 1948 and 1949, the works received only two orders for depth pumps. Other oil machinery works are engaged on production of depth pumps. The orders carried out by the Borets Works were for insertion depth pumps type NGN-3 with two valves, sizes 32 and 43 mm.

Tube Air Blowers. (Trubovozdukhoduvka)

22. The works produce tube air blowers of three types.

Steam Engines

23. The works produce a steam engine type PMB (Parovaya Mashina Borets, Borets Steam Engine), which has 350 revolutions per minute and 350 HP. The engine has variable steam admission, automatic lubrication of cylinders and parts, Stephenson link gear, and centralized control. The engine has been in series production since the end of 1946 and is intended for the oil industry for drilling operations in areas where electric power is not available.

Diesel Oil Engines

24. The works produce Diesel oil engines of five types which include the following:

a. Type ND-22 (Neftyanoi Dvigatel, Oil Engine); power: 22 HP.

b. Type ND-40; power: 40 HP. Production started at the beginning of 1946.

c. Type ND-300 with 300 HP is also called type D-6 or D-6-31. It operates with 1500 revolutions per minute. This engine is intended for drilling wells at oil workings. As a rule, two ND-300 Diesel engines are employed for drilling: one for the drilling machine and the other for driving the mud pumps. The first 300 HP Diesel was produced in September 1947. These Diesel engines can be easily moved from one well to another.

Steam Turbines

25. The works produce two types of steam turbines of 20 and 70 HP. The first turbine was produced in November 1948.

Turbine Drills (Turbobur)

26. The works have so far only carried out one order for a small number of sets

rotors and stators for turbine drills types T 12 M 9 3/4 Dyuima (Inch) and T 14 M 9 3/4 Dyuima. By 1 January 1950, the works produced 3600 sets of rotors and stators. The works produce rotors and stators of wrought iron. A special thermic treatment section has been organized at the foundry shop for annealing these articles.

Small turbines for cleaning

27. The works produce special small turbines for cleaning pumps and compressor tubes. By means of these turbines it is possible to clean the inside of tubes and pipes on the spot at the oil wells during periods when oil wells are stopped for repairs. The diameter of these small turbines produced by the works is 74.5 mm for 3 inch tubes. First models of small turbines for 4 and 6 inch tubes have been produced.

Ventilators for cooling towers

28. The works produce ventilators for water cooling towers (Gradirnya). These cooling towers are for cooling water at compressor stations.

Lifting winches

29. The works produce one-ton lifting winches Kirschenbaum type V-1-M for assembling oil derricks.

Agricultural Machinery

30. The works produce ND-22 Diesel engines for agricultural electrification. The works are also carrying out orders for spare parts for agricultural machinery. For instance, in 1949, the works produced about 20,000 tractor pistons. Parts for sowing, threshing, and other machines are also produced.

Fire Grate Bars

31. The works also produce tens of thousands of fire grate bars weighing 3 and 6 kg.

Personnel

32. Following is a list of the chief personnel of the Borets works:

a. Directors and Chiefs:

Director	-	Semen Markovich Rotenshtein, who has held this appointment since the war
Deputy Director	-	Vladimir Aleksandrovich Levedev.
Deputy Director for Workers Supply	-	Rafail Yevseyevich Liberman.
Chief Engineer	-	Stepan Vladimirovich Konstantinov.
Chief Technologist	-	Grigori Zinovyevich Oradovski
Chief Designer	-	Vladimir Aleksandrovich Getiye
Chief of Production	-	Mikhail Stepanovich Belyayev. He replaced Sergei Andreyevich Gerasimov in 1948.
Chief Mechanic	-	Ivan Petrovich Kremenetski.

b. Heads of the Main Shops:

Head of the 1st Engineering Shop	-	Vladimir Kusmich Nikolayev.
Head of the 2nd Engineering Shop	-	Grigori Grigoryevich Belyayev.
Head of the 3rd Engineering Shop	-	Petr Vasiliyevich Galkin.
Head of the Foundry	-	Boris Vladimirovich Shibanov.
Head of the Forge	-	Valentin Pavlovich Bakhtin.
Head of the Pattern Shop	-	Innokenti Yefimovich Baigushev.
Head of the Electrical Shop	-	Spiridon Grigoryevich Konstantinov.
Head of the 1st Assembling Shop	-	Martin Varfolomeyevich Tomashek.
Head of the 2nd Assembling Shop	-	Mikhail Petrovich Antipov.
Head of the Tool Shop	-	Mikhail Lvovich Gorelikov.
Head of the Transport Shop	-	Vladimir Andreyevich Palekha.
Head of the Thermic Shop	-	Vasili Dmitriyevich Polyakov.
Head of the Preparatory Shop	-	Yakov Ivanovich Shapovalenko
Head of the Repair Shop	-	Ivan Mikhailovich Zlotnikov.
Head of the Testing Station of the Works	-	Igor Nadsimovich Vaisboroda.
Head of the Works' Laboratory	-	Yevstrati Ivanovich Markoyanov.

c. Heads of Sections of the Works:
I. T. Samoilenko (Technical Control Section).
V. S. Kaplan (Technical Training Section)
G. I. Nesterov (Supply Section)
R. B. Pikus (Planning Section)
G. O. Vulf (Sales Section), and others.

d. Engineer Technologists of the Works:

I. V. Bogachev	P. K. Bratishchenko	G. I. Melenin	Z. F. Ruskov
P. V. Vasiliyev	N. I. Shmelev	V. I. Pimenov	S. I. Danilin
A. F. Golubkov	N. P. Shumilov	A. Ya. Belik	I. S. Sobolev
V. G. Ryabinkin	G. P. Shchukin	S. V. Matveichev	and others.

e. Engineer Designers of the Works:

N. V. Sivokhin	V. I. Elin	S. M. Berezin	A. I. Avdeyenko
N. M. Zimin	A. S. Kulikov	P. I. Melnikov	E. I. Pluzhenko
			and others.

33. The number of personnel employed at the Works is about 6000. The work is conducted in three shifts of 8 hours each: morning, afternoon, and night shifts. Until 1948, work during the night shift was unsatisfactory and considerably inferior to that during the morning and afternoon shifts. However, in 1949, after a rearrangement of duties of a number of specialists and improvements in organization, the output approached that of the other shifts and on occasions surpassed it.

Output

34. The approximate total output of machines for 1949 was about 2600. These machines consisted of compressors, pumps, air blowers, 3 types of Diesels, steam engines, steam turbines, and winches. The output of steam engines, steam turbines, Diesels, and winches is comparatively small in comparison with compressors, pumps, and air blowers.

35. Following are a few details regarding output:

a. Compressors: In 1946, about 600 compressors were produced and, in 1949, approximately 1200 were produced.

b. Steam Turbines: About 20 steam turbines in all have been produced at the works. Production of turbines started in November 1948.

c. Steam Engines: Series production of steam engines commenced in 1947, during which year 75 steam engines were produced. Output increased slightly from year to year. In 1949, about 150 steam engines type PMB were produced.

d. Diesel Engines: In 1949, about 500 Diesels of three types were produced.

e. Winches: In 1949, only two orders, each for 40 winches, were executed.

f. Spare Parts: The production of spare parts plays an important role in the factory. Details of output are not available. Large numbers of valves for compressor pumps of various types are produced by continuous line method in the 3rd shop. Bushes for "Ideal" mud pumps, saddles, etc. are also produced by continuous line methods.

General Condition of the Factory

36. During the post-war Five Year Plan, considerable improvements have taken place both in organization and equipment at the works. A large part of the foundry has been mechanized, including the section where cores are produced. New cranes and roller conveyers have been installed. Mechanical charging of cupola furnaces has been brought in. Mould filling has been mechanized and wet moulding has been introduced. In the Thermic Shop three new electric furnaces have been installed. The 3rd Engineering Shop has received equipment for hardening by high frequency current. The Forge has been equipped with powerful hammers and has received presses for hot stamping. The improvement in the work at the factory is also the result of the higher qualifications possessed by workers who have been through technical courses which have been held without interruption since the war.

37. A great many workers are employing high speed methods with metal-working machine tools not only with steel but also with cast iron. This is important because 65 percent of articles machined are of cast iron. Special cutters of hard alloys VK-2 (wolfram and cobalt) are used for machining cast iron.

38. At the conclusion of hostilities, the machine tool equipment at the factory was in a very bad state. During the war, when orders had to be fulfilled at all cost, little care and attention was given to the upkeep and repair of machine tools. In 1947, steps were taken gradually to put the machine tool equipment in order. Many machine tools had not received a complete overhaul for 10-12 years. Periods during which machinery was idle were very long. In 1946, the idle periods amounted to about 40,000 hours and, in 1947, to about 30,000 hours. The Repair Shop was quite unable to cope with the work required.

39. The situation has now improved somewhat owing to the arrival of new machine tools, the number of which, however, is quite inadequate. Machine tools continue to wear out quickly owing to continuous work and repeated demands for increased output by highspeed methods. Many workers say among themselves, "We are again wearing out the machines as we did during the war."